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ABSTRACT

An assessment study was conducted on the effectiveness of a cognitive education program, Feuerstein's Instrumental Enrichment, in meeting the needs of a class of low achieving adolescents at a vocational school in Calgary, Canada. Fifteen students participated in an Instrumental Enrichment class for one 45 minute period five days a week over two years. They were compared to a group of similar students who did not receive the program. Students were assessed at the beginning of the study, at the end of each year of the program, and one year after the program was completed. They were reassessed in four areas: (1) reasoning and intelligence; (2) achievement; (3) attitudes; and (4) behavior. In addition, teachers in the project school were surveyed to ascertain their beliefs and attitudes towards low achieving students and the experimental program. Results indicated few significant differences between the groups on the retest data over the three years. However, there was considerable attrition from the study each year and examination of the reasons for attrition indicated that it was not random. It was found that students in the experimental group who had high reading and mathematics scores were more likely to move to other schools to pursue academic programs than were low scoring experimental students or high and low scoring controls. They were also more likely to remain in school than were the control group. While absentee rates did not differ significantly for the two groups, control students who had high absentee rates were more likely to leave school than were experimental students. Teachers' attitudes to this program were extremely positive, and teachers' attitudes toward reasons for failure of normally intelligent students shifted over the course of the study to include poor thinking skills. (Author/KH)

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Instrumental Enrichment With Low Achieving Adolescents

Planning Services

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INSTRUMENTAL ENRICHMENT WITH LOW ACHIEVING ADOLESCENTS

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ABSTRACT

The purpose of this study was to evaluate the effect of a cognitive education program, Feuerstein's Instrumental Enrichment on a class of low achieving adolescents at a vocational school. Fifteen students participated in an Instrumental Enrichment class for one 45 minute period five days a week over two years. They were compared to a group of similar students who did not receive the program.

Students were assessed at the beginning of the study, at the end of each year of the program and one year after the program was completed. They were reassessed in four areas: 1) reasoning and intelligence; 2) achievement; 3) attitudes; and 4) behavior. In addition, teachers in the project school were surveyed to ascertain their beliefs and attitudes towards low achieveing students and the experimental program.

Results indicated few significant differences between the groups on the retest data over the three years. However, there was considerable attrition from the study each year and examination of the reasons for attrition indicated that it was not random. It was found that students in the experimental group who had high reading and mathematics scores were more likely to move to other schools to pursue academic programs than were low scoring experimental students or high and low scoring controls. They were also more likely to remain in school than were the control group. While absentee rates did not differ significantly for the two groups, control students who had high absentee rates were more likely to leave school than were experimental students. Teacher attitudes to this program were extremely positive and teachers' attitudes toward reasons for failure of normally intelligent students shifted over the course of the study to include poor thinking skills.

The need to examine attrition, to develop more sensitive measures for assessing change, to use a larger sample size and more than one teacher and the need to study changes in both students and teachers are discussed. Recommendations for future investigations are suggested.

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INSTRUMENTAL ENRICHMENT WITH LOW ACHIEVING ADOLESCENTS

I. INTRODUCTION

During the past several years the disappointing results from remedial programs for students with learning problems have encouraged educators to look for new approaches to remediation. Emphasis has shifted from content oriented remedial approaches to cognitive or process oriented approaches that stress teaching strategies for thinking and learning (Waksman, 1983). The rationale behind these programs is that students must learn how to learn and must become more effective problem solvers if they are going to be successful in school and beyond.

A. Feuerstein's Instrumental Enrichment Program

One approach that stresses teaching underlying prerequisites and processes of learning, Instrumental Enrichment (Feuerstein et al, 1980), has been of considerable interest in recent years. The program has been implemented in Israel for many years (Rand, Tannebaum, and Feuerstein, 1979) and more recently in Venezuela on a large scale (Minister, 1980, 1982). It has also been used and evaluated in the United States (Haywood et al, 1982) and in Canada (Narrol, Silverman, and Waksman, 1982).

Feuerstein's Instrumental Enrichment (I.E.) program is essentially a content-free program designed for adolescents and adults, which consists of paper and pencil exercises and class discussion. The exercises grouped into fifteen 'instruments'focus on the correction of deficient cognitive functions such as comparative behaviour, systematic search, planning, hypothesis testing, spatial and temporal relations and ability to consider two or more sources of information simultaneously. The class discussion

ensures that students understand the meaning of the exercises, how their behaviour affects their performance and how the principles and strategies learned on these exercises relate to other areas, academic, social and vocational. The program is taught by a teacher who has been trained on the underlying theoretical model and on ways to intervene to correct deficient cognitive functions and promote change.

The Instrumental Enrichment program has been analyzed from the perspective of theories and research in cognition and cognitive development. In general, it has been argued that the program emphasizes activities for efficient learning and problem solving (Bransford et al, in press; Sternberg, in press) and metacognitive processes (Brown, 1977). The authors of the program (Feuerstein et al, 1980) present the program's general goal as the modifiability of intellectual functioning, so that the individual will be better able to adapt and adjust to everchanging life conditions. They believe that the cognitive behaviour of human beings is amenable to structural change, that is, changes that affect the totality of behaviour and are self-perpetuating, so that the quality and level of thinking is affected. With appropriate intervention, referred to as mediated learning experiences, individuals can change in meaningful ways so that they benefit both more and differently from their experiences (Feuerstein and Jensen, 1980). Structural change is a slow process as new habits and skills must be learned and thus the authors argue that their approach must be used over a prolonged period. The Instrumental Enrichment program is designed to be used for approximately one hour per day, three to five days per week over a two year period. It is considered a supplement to content teaching rather than a replacement program.

While the Instrumental Enrichment program appears to have much intuitive appeal and if the claims made for it prove to be correct, it would have serious implications for special education practice, evaluation data to date leaves many questions. The purpose of this study was to evaluate the effect of Instrumental Enrichment on one class of low achieving adolescents in a vocational high school setting. This population was chosen for study as school personnel felt that traditional approaches were not effecting change and other research had indicated that Instrumental Enrichment was effective for this population.

B. Review of Instrumental Enrichment Evaluation Studies

One study by Narrol, Silverman and Waksman (1982) compared five classes of vocational high school students receiving the Instrumental Enrichment program with five control classes and found significant differences after one year in favour of the experimental classes on standarized tests of intelligence. They did not find significant differences on measures of self esteem or locus of control and did not measure the effect of the program on achievement in academic areas. They argued that the program was of too short duration to begin to see effects in areas such as self esteem and locus of control.

Haywood et al (1982) reported on a series of studies evaluating this program with over one hundred (100) teachers and one thousand (1000) students. The study evaluated classes in three different cities in the southern United States that used the Instrumental Enrichment Program for one year, with children with varying special education labels (e.g. learning disabled, emotionally disturbed, culturally different and 'low functioning').

They found that, in general, the Instrumental Enrichment program was effective but that the success of the program varied depending on the type of disability, the mode of implementation and the number of hours that the program was implemented for. The program was found to be most successful with children of normal intelligence who were diagnosed as learning disabled. It was also more successful when taught by a teacher within the school rather than an itinerant teacher. The program appeared to work best when both Instrumental Enrichment and content instruction were offered by the same teacher. This finding is of interest as it may indicate that the general mediation style of the teacher is as critical as the specific intervention program. The authors found that the program was not teacher proof but exactly what characterizes more and less effective Instrumental Enrichment teachers has yet to be specified. This study also found that there were a minimum number of hours that the program needed to be implemented in order for it to be successful. This minimum appeared to be three 45 - 60 minute sessions per week, the minimum time recommended by the authors of the Instrumental Enrichment program.

A major goal of the Instrumental Enrichment program is to increase the modifiability of students so that they are better able to benefit from other learning experiences. This implies that there should and must be generalization from the program to other areas such as academic achievement and attitudes. To date the data on this transfer is weak. The Haywood et al (1982) studies reported some transfer but argued that evaluation of a cognitive curriculum cannot be done by standard tests alone. The program targets cognitive areas and they argued that it takes some time for the second order effects on, for example, reading and mathematics achievement to occur. The studies reported above have only evaluated the program for

one year. In order to evaluate the effects of this program fully students should participate for the two year period with re-evaluation at some point after the instruction has ended.

Rand, Tannenbaum and Feuerstein (1979) compared the effect of an Instrumental Enrichment program with a general content enrichment program on low achieving, economically, and socially disadvantaged students. Their study was carried out over a two year period assessing over five hundred (500) students in Israel. They found changes in favour of the Instrumental Enrichment groups on the Thurstone Primary Mental Abilities Scale, and on a classroom participation scale assessing factors such as conduct, self-sufficiency and adaptiveness to work demands. They did not find a difference between the experimental and control groups on the achievement battery or the self-concept scales. The students in this study were followed up several years later when they entered the Israeli army and were compared to a third group who had not participated in the study or received special help, but who came from similar backgrounds. Preliminary results of that study (Feuerstein et al, 1980) indicated that those students who had received the Instrumental Enrichment program achieved higher scores than the general enrichment and the third group on the army intelligence test. The scores of the Instrumental Enrichment students were actually higher than they had been at the end of the Instrumental Enrichment program. They also found that those students who had received only one year of Instrumental Enrichment scored significantly lower on the army tests, than those who had received two years. Students in both enrichment groups surpassed the third group who had not received any intervention. Thus, these results support the authors' contention that changes in cognitive functioning take

time and that the benefits will continue after the actual intervention program ceases.

II. PURPOSE

The present study was designed to investigate the effectiveness of the Instrumental Enrichment Program on a small group of low achieving adolescents over a three year period. In particular, we were interested in studying the effects of this program on cognitive, academic, attitudinal and behavioural changes. One of the concerns expressed in the project school was the poor attendance and high "drop-out" rate of this population and thus we were interested in examining how implementation of a program designed to help students become more responsible for their own learning would affect attitudes toward school and behaviour both in classes and in school attendance generally.

A second objective of the study was to investigate teacher attitudes to a program designed to teach learning and thinking skills rather than academic content. Teacher attitudes toward the program were considered critical to its success given that other research (Alley and Deshler, 1979) has indicated that generalization does not occur without explicit instruction and given that the materials for this program could be easily misunderstood by uninitiated teachers. Anecdotal reports from other research sites indicated that teachers who were not familiar with the program often belittled it, thus, affecting the students' attitudes towards the program (Waksman, personal communication).

This study was designed to investigate the following questions:

1. Is Instrumental Enrichment effective in changing thinking skills and

learning strategies of low achieving adolescents when offered over a two year period?

2. Is Instrumental Enrichment effective in raising achievement scores in academic areas such as reading and mathematics?
3. Is Instrumental Enrichment effective in changing students' attitudes towards their own abilities and toward education in general?
4. Is Instrumental Enrichment effective in changing the behaviour of students as perceived by teachers and other observers and as measured by attendance, "drop-out" rates and school transfers?
5. Will the effects of the Instrumental Enrichment Program be evident one year after the program is completed?
6. What are the attitudes of teachers toward cognitive education?
7. Are inservice presentations effective in increasing awareness and in changing teachers' attitudes towards this program?

III. METHOD

A. SUBJECTS:

Thirty-one (31) students between the ages of thirteen (13) and fifteen (15) attending a vocational high school were selected for this study by their school counsellors based on the following criteria:

(1) Average Intelligence as tested by the Wechsler Intelligence Scale for Children - Revised (WISC-R); Full Scale of at least 90 or above 90 on either the Verbal or Performance subscale.

(2) Below average achievement: three or more years behind in two major subject areas.

(3) No history of serious attendance or behaviour problems and stated commitment to remain in school for the next two years.

(4) No history of severe language delay or difficulties.

Fifteen (15) students (8 boys and 7 girls) were randomly assigned to the experimental group (mean age = 13.9 years), and sixteen (16) students (11 boys and 5 girls) to the control group (mean age = 13.9 years) by a school counsellor. The mean I.Q. scores were 94.0 and 90.1 for the experimental and control groups respectively. These scores were not significantly different ($t = 1.29$ $p = 0.21$). Students met the criteria in all other areas. Reading and mathematics achievement averaged 3 - 4 years below grade level. There were no significant differences between the groups on any variable (see Table 2, page 17).

B. PROJECT SCHOOL:

The project school was a secondary vocational school for students who were unable to achieve well in academic programs. Students at this school are bused from all over the city. The population of five hundred (500) students is 60% male and tends to be highly mobile. The goal of the school is to help students acquire skills in various occupations so that upon graduation they can acquire employment. Academic courses (language arts, mathematics, social studies and science) are also required. These courses are designed to be practical and to provide basic skills.

C. PROCEDURE:

1. Evaluation of Student Progress

All students were assessed by examiners who did not know whether the student had been assigned to the experimental or the control group. Students were tested at the beginning of the study (September - October, 1981), at the end of the first year (May - June, 1982), at the end of the second year (May - June, 1983) and one year after the program ended (May - June, 1984).

In addition, behavioural observations were carried out on both groups of students in the spring of each year in academic and shop classes. Teachers in these classes also filled out behavioural ratings on students in the spring of each year.

In addition to the data collected on the students over the three year period, teachers' attitudes were assessed concerning their beliefs about non-achievers and their understanding and knowledge of the intervention program in question, Instrumental Enrichment. The questionnaires were administered at the beginning of the program and toward the end of year 2.

Evaluation data was collected in four areas: (Refer to Table 1)

(a) reasoning and intelligence;

(b) academic achievement;

(c) attitudes;

(d) behaviour.

(a) Reasoning and Intelligence Tests

1. Raven's Standard Progressive Matrices [1981, 1984][1]

This is a non-verbal test of reasoning that correlates with other tests of intelligence. It was administered individually in 1981 and in groups in 1984 (Raven, 1956).

2. Wechsler Intelligence Scale for Children - Revised (WISC-R) [1981, 1983]

The WISC-R is the most commonly used intelligence measure in the project area. In 1981 this test was administered to those students who had not been assessed in the previous four years. In 1983 it was administered to all students.

[1] Dates in square parentheses [] indicate administration dates.

Table 1

Tests Administered

	Initial	End Year 1	End Year 2	End Year 3
a) Reasoning and Intelligence Tests				
Raven's	x	-	-	x
WISC-R	x	-	x	-
Woodcock-Johnson Reasoning ...	x	x	x	x
Set Variations II	-	-	x	x
Numerical Progressions	x	x	-	x
Complex Figure	-	-	x	-
b) Achievement Tests				
Stanford Diag. Math	x	-	-	-
CTBS	-	x	x	x
Woodcock-Johnson Math	x	x	x	x
Woodcock-Johnson Reading.....	x	x	x	x
c) Attitude Tests				
Holtzman and Brown	x	x	x	x
Williams	x	x	x	x
d) Behavior Tests				
Stony Brook	-	x	x	x
Teacher Behavior Ratings	x	x	x	x

3. Woodcock-Johnson Reasoning Cluster [1981, 1982, 1983, 1984]

This test consists of four subtests from the Woodcock-Johnson Psycho-educational Battery, believed to measure reasoning ability. The subtests comprising the reasoning cluster are analysis-synthesis, concept formation, analogies, and antonyms-synonyms (Woodcock and Johnson, 1977).

4. Learning Potential Assessment Device

This assessment device (Feuerstein, 1979) uses a teach-test approach to assess students' abilities to profit from instruction. The following subtests were group administered:

(i) Numerical Progressions, [1981, 1982, 1984]

(ii) Set Variations II, [1983, 1984]

(iii) Rey's Complex Figure [1983]

Rey's Complex Figure was not readministered as students reached a ceiling in the first administration.

(b) Achievement Tests

1. Stanford Diagnostic Mathematics Test, [1981]

A group test of mathematical achievement consisting of numeration, computation, and application subtests. This test was administered in the initial test period only as school personnel preferred that we switch to the Canadian Test of Basic Skills.

2. Canadian Test of Basic Skills, [1982, 1983, 1984]

A group test that measures achievement in areas such as mathematics, reading and vocabulary. While this is the most commonly used achievement test in the project area, there are some concerns that skills measured by the Canadian Test of Basic Skills do not match the curriculum in the Province of Alberta.

3. Woodcock-Johnson Reading Cluster, [1981, 1982, 1983, 1984]

This test consists of three subtests of the Woodcock-Johnson Psycho-educational Battery: letter word identification, word attack, and passage comprehension.

4. Woodcock-Johnson Mathematics Cluster [1981, 1982, 1983, 1984]

This cluster consists of two subtests from the Woodcock-Johnson Psycho-educational Battery: calculation and applied problems.

(c) Attitude Tests

1. Modified version of the Holtzman and Brown Survey (Khan, 1966) of Study Habits and Attitudes, [1981, 1982, 1983, 1984]

This survey was administered orally to each student to avoid confounding with reading ability. The student was asked to rate on a scale from one to five how a particular statement applied to him. Factors included attitude toward education in general and towards teachers, academic interest, need achievement, achievement anxiety, study habits and motivation.

2. Williams Perception of Thinking Abilities, [1981, 1982, 1983,1984]

On this scale (Williams, 1972), the student was required to rate on a scale of one to five how closely particular statements such as "I make an effort to try new things", "I have more mental ability than I use", pertain to him. Again this scale was administered individually with the examiner reading the items.

(d) Behaviour

In addition to the tests administered three types of behavioural data were collected.

1. Stony Brook Classroom Observation Code (Abikoff, Gittleman-Klein and Klein, 1977) [1982, 1983, 1984]

All students were observed using the Stony Brook Classroom Observation Code.

Students were observed in a mathematics class and in a language arts class by an observer who did not know which students were controls and which were experimentals. They were rated in eight areas: interference, off-task behaviour, non-compliance, minor motor movements, gross motor, out of chair behaviour, response to questions and requests for clarification for sixteen (16) minute periods. A description of the Stony Brook Observation Code is included in Appendix E.

2. Teacher Behaviour Rating Scale (Appendix A), [1981, 1982, 1983, 1984]

Students were rated by three of their teachers; mathematics, language arts, and vocational, on particular classroom behaviours such as "student hands in assignments on time" and "student asks appropriate questions". This scale was developed specifically for this study in an attempt to target behaviours that the authors of the Instrumental Enrichment program believe are affected by the program.

3. Attendance and Attrition

The number of days that students attended school and the number of late days were recorded for the three years. In addition, attempts were made to locate all students who left the project school during the three years. Records were kept as to whether the student transferred to another school or left school entirely. These students were not reassessed after leaving the project school due to financial and time constraints.

2. Intervention Program

Students in the experimental group spent 45 minutes per day being taught Instrumental Enrichment. This class was at a specific time each day and students attended it instead of the class scheduled for that time. Students received credit for this course. Students in the control group

attended all their regular classes and thus received more instruction than the experimental group in content courses.

The intervention program was taught by an itinerant teacher from the Learning Centre who was trained in the Instrumental Enrichment program. This training involved three, one-week long workshops on the theory underlying the Instrumental Enrichment Program, the goals and objectives of the program, intervention techniques and specific approaches for teaching the Instrumental Enrichment material. The authors of the program also suggest that teachers be supervised in the use of the program for at least two years. The teacher in this study had received only six months supervision but was observed and supervised by one of the authors of the program and considered an effective Instrumental Enrichment teacher. An itinerant teacher was used for this study because she was the only trained teacher in Instrumental Enrichment in the project area when the study began. This same teacher also provided the inservice sessions for teachers described below.

Instrumental Enrichment (Feuerstein et al, 1980) consists of fifteen (15) "instruments" which are paper and pencil exercises covering a wide range of cognitive functions. Each instrument focuses on a particular set of deficient functions such as lack of spontaneous comparative behaviour, poor spatial orientation, unsystematic search behaviour, lack of need for precision and accuracy, and inability to consider two or more pieces of information simultaneously. The general goal of the program is to teach the prerequisite thinking skills such that the individual is better able to benefit from both academic and life experiences.

The specific subgoals are:

(1) correction of deficient cognitive functions;

(2) acquisition of vocabulary, concepts, operations and relationships relevant to the program;

(3) formation of good learning habits;

(4) production of intrinsic motivation;

(5) creation of insight and reflective thinking;

(6) shift from role of passive recipient and producer of information to that of active generator of new information.

An important aspect of the Instrumental Enrichment Program is that students understand what they are doing and generalize or bridge from the principles and strategies being taught on a particular page to other areas of academic and general functioning.

Thus, in addition to simply doing the paper and pencil exercises, students discuss what and why they are doing a particular exercise. The mediational style and skill of the teacher in leading this discussion period is critical to the program's success. Appendix B gives a summary of the characteristics of the program.

Over the two years, ten instruments were taught. Instruments were taught in the order presented but there was always more than one instrument being used at a time. The teacher attempted to teach the program exactly as outlined by the authors.

Year 1 Instruments

Organization of Dots

Orientation in Space I

Comparisons

Analytic Perception

Categorization

Numerical Progressions

Year 2 Instruments

Organization of Dots (completed instrument from Year 1)

Numerical Progressions (completed instrument from Year 1)

Instructions

Family Relations

Temporal Relations

Illustrations (used intermittently throughout Years 1 and 2)

Appendix C gives a description of the instruments and sample problems.

3. Inservice for Teachers

Three one-hour inservice sessions were provided for teachers at the project school to familiarize them with the project. These were offered in October, 1981, at the beginning of the program, in February, 1982, and February, 1983. The sessions consisted of discussion on the theoretical basis for the program, the goals of the program and an overview of the instruments. Teacher attitudes were assessed before and after the inservice sessions, using a scale specifically developed for this study (Appendix D). It measured teacher's beliefs about why students of normal intelligence might fail in school, which of the causes for failure could be changed and knowledge of the Instrumental Enrichment program at the project school.

IV. RESULTS

A. INITIAL STATUS OF STUDENTS:

Comparisons were made between the experimental and control groups at the beginning of the study on the initial test results and on sex and age variables. There were no significant differences between the two groups

Comparison of Experimental and Control Group at the Beginning of Year 1

Table 2a

	Exp. N=15 Means	S.D.	Cont. N=16 Means	S.D.	F Ratio	P	t-test	P
Sex					0.24	0.60	-0.49	0.62
Age	13.9yrs	0.70yrs	13.8yrs	1.02yrs	0.03	0.86	0.19	0.90

Table 2b

	Exp. N=15 Means	S.D.	Cont. N=16 Means	S.D.	F Ratio	P	t-test	P
Reasoning and Intelligence Tests								
WISCv	90.6 IQ	7.5	86.6 IQ	6.9	2.86	0.11	1.54	0.13
WISCp	99.3 IQ	12.6	95.6 IQ	9.1	2.36	0.13	0.94	0.35
WISCfs	94.0 IQ	9.7	90.1 IQ	7.1	2.50	0.12	1.29	0.21
Raven's	38.1[a]	7.4	29.4[a]	13.5	1.45	0.24	1.23	0.23
Woodcock-Johnson Reasoning	129.9 mos	29.0	130.4 mos	57.7	0.001	0.98	-0.03	0.98
Numerical Progressions	12.4 mos	7.7	14.22 mos	7.4	0.40	0.54	____	____

[a]Where no units are indicated, means are raw score

Comparison of Experimental and Control Group at the Beginning of Year 1

Table 2c

	Exp. N=15 Means	S.D.	Cont. N=16 Means	S.D.	F Ratio	P	t-test	P
Achievement Tests								
Stanford Math								
Concepts	10.9%ile	10.6	10.6%ile	11.5	0.004	0.95	0.06	0.95
Comparison	9.1%ile	10.3	7.9%ile	8.2	0.13	0.72	0.36	0.72
Application	14.5%ile	17.3	8.0%ile	12.5	1.50	0.24	1.20	0.24
Woodcock-Johnson Math	128.5 mos	38.7	137.6 mos	21.9	0.67	0.42	-0.80	0.43
Woodcock- Johnson Reading	122.6 mos	40.2	120.0 mos	21.2	0.05	0.82	0.22	0.83

Comparison of Experiment and Control Group at the Beginning of Year 1

Table 2d

Variations	Exp. N=15 Means	S.D.	Exp. N=16 Means	S.D.	F Ratio	P	t-test	P
Attitude Tests								
Education in general	46.6[a]	11.4	43.9[a]	4.2	0.81	0.37	0.88	0.39
Toward teachers	78.1	9.6	76.8	9.9	0.13	0.72	0.36	0.72
Study Habits	104.4	16.3	104.3	10.9	0.001	0.98	0.03	0.98
Academic motivation	42.0	6.4	41.4	7.3	0.05	0.82	0.23	0.82
Interest in academics	30.6	4.2	29.1	9.4	0.37	0.55	0.62	0.54
Need Achievement	32.6	7.5	37.1	6.1	3.43	0.08	-1.84	0.08
Achievement Anxiety	39.9	6.7	41.3	5.4	0.41	0.53	-0.63	0.53
Perception/Thinking ability	22.7	7.0	24.0	6.5	0.18	0.73	-0.34	0.73

[a]Where no units indicated, means are raw score

on any variable. Table 2 presents the mean scores, F ratios and t-test values.

B. REASSESSMENT AT END OF YEARS 1, 2, AND 3

The amount of change was examined for both groups using a repeated measure, Analysis of Variance (BMDP2V). Data for each year was examined separately as the number of students available for reassessment decreased each year. The problem of how attrition of students from the study may be affecting retest means is a critical one that should be kept in mind as the data is reviewed. It is discussed in detail in the section on attendance and attrition (Page 36).

1. Results of Reasoning and Intelligence Tests

1. Woodcock-Johnson Reasoning Cluster

Table 3 presents the means and F-values on the Woodcock-Johnson Reasoning Cluster. At the end of Year 1 there were no significant differences between groups or changes over time. At the end of Year 2 the groups still did not differ but both groups had shown significant gains ($Fw = 5.70$, $p = 0.007$) on this test. At the end of Year 3 there were significant gains for both groups. ($Fw = 4.42$, $p = 0.01$)

2. Wechsler Intelligence Scale for Children - Revised (WISC-R)

Table 4 presents the test-retest data at the end of Year 2 for the WISC-R. There was a significant decline for both groups on the full scale and verbal scores ($Fw=4.4$ $p=0.05$ and $Fw=11.2$ $p=0.004$).

3. Raven's Standard Progressive Matrices

Table 5 presents the initial and retest data for the Raven's. It was administered at the beginning of the study and at the end of Year 3. There are no significant differences between the two groups initially or at the

Table 3

Woodcock-Johnson Reasoning Cluster

	N	Initial Means	Initial S.D.	Year 1 Means	Year 1 S.D.	Year 2 Means	Year 2 S.D.	Year 3 Means	Year 3 S.D.	F Values
Year 1										
Exp.	12	130.00[a]	26.0	160.25	59.7					Fb=0.04 p=0.84 Fw=3.69 p=0.06 Fi=3.69 p=0.68
Control	15	131.00	73.0	150.53	77.3					
Year 2										
Exp.	10	131.0	28.7	147.4	60.6	160.3	68.9			Fb=0.77 p=0.39 Fw=5.70 p=0.007* Fi=0.88 p=0.42
Control	10	137.6	71.3	171.2	85.7	204.7	103.6			
Year 3										
Exp.	7	136.3	28.1	156.1	69.8	171.1	79.4	208.6	99.2	Fb=0.00 p=0.98 Fw=4.42 p=0.01 Fi=0.69 p=0.56
Control	6	117.3	28.6	167.7	80.2	198.3	97.7	185.2	73.1	

[a]mean scores are in months

*indicates significance

Fb: is the variance "between" the experimental and control groups. (The treatment effect.)

Fw: is the variance "within" the two groups. (The effects over time in a repeated measures design.)

Fi: is the interaction between treatment effects and time.

end of Year 3. Both groups have higher mean scores at Year 3 (Fw = 9.25, p = 0.01). As these are raw scores, they do not reflect I.Q. gains.

Table 4

Test-Retest Means: Wechsler Intelligence Scale for Children - Revised

	N	Initial Means (IQ)	Initial S.D. (I.Q.)	Retest Means (I.Q.)	Retest S.D. (I.Q.)	F Value
Full Scale						
Exp.	9	96.2	12.1	88.1	12.4	Fb=0.04 p=0.84 Fw=4.4 p=0.05*
Control	10	92.0	6.04	90.7	8.7	Fi=2.3 p=0.15
Verbal Scale						
Exp.	9	92.7	9.0	83.6	7.7	Fb=0.2 p=0.7 Fw=11.2 p=0.004*
Control	10	87.8	8.1	85.2	9.1	Fi=3.4 p=0.08
Performance						
Exp.	9	101.0	15.7	95.3	18.2	Fb=0.01 p=0.91 Fw=0.6 p=0.43
Control	10	98.1	6.2	99.5	9.7	Fi=1.7 p=0.2

Table 5

Raven's Standard Progressive Matrices

All Subjects				Remaining Subjects					
		Initial			Initial		Year 3		
	N	Means	S.D.	N	Means	S.D.	Means	S.D.	F Values
Exp.	14	34.1[a]	7.3	7	35.8	6.6	41.0	9.8	Fb=0.34 p=0.57 Fw=9.25 p=0.01* Fi=0.86 p=0.37
Control	15	33.6	13.5	6	35.6	8.8	45.3	3.9	

[a] mean scores are given as raw scores.

4. Learning Potential Assessment Device

The Numerical Progressions subtest was administered at the end of Year 1 and again in Year 3. Table 6 presents the means and F-values for this subtest. There was a significant interaction indicating the experimental group scores changed more than the controls (Fi=9.18 p=0.008).

At the end of Year 3 both groups scored significantly higher than they did in Year 1 (Fw=4.17 p=0.02).

Two other subtests from the Learning Potential Assessment Device were administered. Set Variations II, an analogical reasoning test was administered at the end of Years 2 and 3. Table 7 presents the means at the end of Year 2 for ten (10) students in each group and again in Year 3 with seven (7) and six (6) students respectively. There were no significant differences between groups. At the end of Year 3 both groups performed significantly better than in Year 3 (Fw=8.72 p=0.01).

Rey's Complex Figure, a drawing task requiring good organization skills was also administered at the end of Year 2. There were no significant differences between the groups (t= -0.48 p=0.64), with both groups achieving almost perfect scores.

2. Achievement Test Changes

a. Reading Achievement

Achievement in reading was measured by the Woodcock-Johnson Reading Cluster, administered individually in all four test periods and the Canadian Test of Basic Skills (C.T.B.S.) administered in groups at the end of Years 1, 2, and 3. Results at the end of the first year (Table 8) indicated that the experimental group made significant gains over the control group as assessed by the Woodcock-Johnson (Fi=6.74 p=0.02).

Table 6

Comparison of Numerical Progressions Subtest

Year 1	N	Initial Means	S.D.	Year 1 Means	S.D.	Year 3 Means	S.D.	F Values
Exp.	9	12.44[a]	7.7	20.00[a]	4.7			Fb=0.40 p=0.54 Fw=8.65 p=0.01* Fi=9.18 p=0.008*
Control	9	14.22	7.4	14.11	9.0			
Year 3								
Exp.	7	15.1	6.4	20.7	5.1	20.0	5.9	Fb=0.64 p=0.44 Fw=4.17 p=0.02* Fi=1.29 p=0.30
Control	6	14.3	8.1	15.1	8.0	18.0	8.7	

[a] means are raw scores

* indicates significance

Fb: is the variance "between" the experimental and control groups. (The treatment effect.)

Fw: is the variance "within" the two groups. (The effects over time in a repeated measures design.)

Fi: is the interaction between treatment effects and time.

Table 7

Set Variations II

		Year 2			Year 3		
	N	Means	S.D.	t-value	Means	S.D.	F Value
Year 2							
Exp.	10	30.2[a]	8.3	t=1.70 p=0.106			
Control	10	24.5	12.2				
Year 3							
Exp.	7	29.9	6.1		34.1	5.9	Fb=0.94 p=0.35 Fw=8,72 p=0.01* Fi=0.05 p=0.82
Control	6	25.0	9.9		30.5	9.6	

[a] means are raw scores

* indicates significance

Table 8

Comparison of Means on Woodcock-Johnson Reading Cluster

	N	Initial Means	Initial S.D.	Year 1 Means	Year 1 S.D.	Year 2 Means	Year 2 S.D.	Year 3 Means	Year 3 S.D.	F Values
Year 1										
Exp.	11	129.8[a]	19.9	140.5	24.4					Fb=3.12 p=0.09
										Fw=4.40 p=0.04*
Control	11	121.1	21.5	120.0	20.6					Fi=6.74 p=0.02*
Year 2										
Exp.	10	120.9	49.7	143.2	27.5	152.6	31.0			Fb=0.88 p=0.36
										Fw=5.11 p=0.01*
Control	10	121.7	21.9	124.3	21.3	137.9	34.6			Fi=1.56 p=0.22
Year 3										
Exp.	7	107.1	52.0	130.7	21.3	144.3	32.5	158.0	48.6	Fb=0.71 p=0.42
										Fw=7.32 p=0.00*
Control	6	122.2	21.6	129.2	20.4	139.2	29.2	215.2	111.1	Fi=1.56 p=0.22

[a]mean scores are in months

* indicates significance

In Years 2 and 3 there were no significant differences between groups but both groups scored significantly better than on the initial assessment.

On the Canadian Test of Basic Skills, (C.T.B.S., Table 9), there was a significant gain in vocabulary for both groups at the end of Years 2 and 3 (F_w=8.67 p=0.01; F_w=6.92 p=0.005). At the end of Year 3 the control group also scored significantly higher than the experimental group on reading (F_b=13.60 p=0.0001).

b. Mathematics Achievement

Achievement in mathematics was assessed by the Woodcock-Johnson Mathematics Cluster, (administered individually four times during the study) and the Canadian Test of Basic Skills, (administered as a group in Years 1, 2, and 3).

Table 10 presents the means for the Woodcock-Johnson Mathematics Cluster. There were no significant differences at the end of Year 1. At the end of Year 2 both groups scored significantly higher than they did initially - (F_w=3.30 p=0.05). It is important to note, however, that the initial mean for the experimental group in Year 1 is 139.8, while in Year 2 it is 122.7. This indicates a change in the composition of the group tested. In Year 1, eleven (11) of the fifteen (15) students were available for re-testing. In Year 2 a different group of ten (10) students, all those remaining at the project school were retested. At the end of Year 3 the control students remaining in the study significantly outperformed their experimental counterparts (F_b=5.27 p=0.04).

On the C.T.B.S., (Table 11), there were no significant differences or significant changes during the first two years. Both groups scored significantly higher in Year 3 on all the Mathematics subtests of the C.T.B.S. and the controls outperformed the experimental group on the Mathematics problems subtest (F_b=5.58 p=0.04).

Table 9

Canadian Test of Basic Skills - Reading

	N	Year 1 Means	Year 1 S.D.	Year 2 Means	Year 2 S.D.	Year 3 Means	Year 3 S.D.	F Value or t-test
Year 1								
Vocabulary								
Exp.	8	9.7[a]	7.6					t=0.65 p=0.52
Control	14	7.9	9.5					
Reading								
Exp.	8	6.3	4.5					t=0.22 p=0.83
Control	14	5.8	7.2					
Year 2								
Vocabulary								
Exp.	9	10.9	8.0	17.8	6.2			Fb=0.19 p=0.67
Control	10	8.4	11.4	16.5	15.2			Fw=8.67 p=0.01* Fi=0.06 p=0.81
Reading								
Exp.	9	6.7	5.1	4.4	4.0			Fb=0.33 p=0.58
Control	10	8.2	8.3	6.0	6.9			Fw=3.76 p=0.07 Fi=0.00 p=0.99
Year 3								
Vocabulary								
Exp.	7	7.4	4.6	18.1	3.8	26.4	29.1	Fb=0.73 p=0.41
Control	6	13.1	12.8	18.5	16.1	42.5	36.7	Fw=6.92 p=0.005* Fi=0.73 p=0.49
Reading								
Exp.	7	5.6	5.0	4.1	3.3	19.4	22.5	Fb=0.74 p=0.41
Control	6	7.3	6.2	4.6	7.6	32.5	24.5	Fw=13.6 p=0.0001* Fi=1.15 p=0.34

[a] mean scores are percentile units

* indicates significance

Table 10

Comparison of Means on Woodcock-Johnson Mathematics Cluster

	N	Initial Means	S.D.	Year 1 Means	S.D.	Year 2 Means	S.D	Year 3 Means	S.D.	F Value
Year 1										
Exp.	11	139.82[a]	17.3	138.64	20.8					Fb=0.01 p=-.91 Fw=0.25 p=0.62
Control	11	138.00	22.6	142.13	17.7					Fi=0.83 p=0.37
Year 2										
Exp.	10	122.7	45.6	135.9	14.9	144.5	13.8			Fb=1.37 p=0.25 Fw=3.30 p=0.05*
Control	10	138.4	22.2	141.8	21.4	154.7	34.9			Fi=0.22 p=0.80
Year 3										
Exp.	7	118.9	55.3	134.4	17.6	147.6	15.7	146.7	33.2	Fb=5.27 p=0.04* Fw=4.80 p=0.007
Control	6	145.8	14.9	147.3	14.2	160.3	28.8	200.0	50.6	Fi=1.37 p=0.27

[a]mean scores are given in months

*indicates significance

Table 11

Comparison of Means for Canadian Test of Basic Skills - Math Subtests

		N	Year 1 Means	Year 1 S.D.	Year 2 Means	Year 2 S.D.	Year 3 Means	Year 3 S.D.	F Value or t-test
Year 1									
Graphs & Tables	E	8	6.1[a]	3.2					t=1.58 p=0.13
	C	14	3.9	3.7					
Math Concepts	E	8	8.5	8.6					t=0.44 p=0.66
	C	14	6.7	10.4					
Math Problems	E	8	11.9	9.9					t=0.33 p=0.74
	C	14	10.5	8.1					
Total Math	E	8	7.6	7.2					t=0.25 p=0.81
	C	14	6.8	8.1					
Year 2									
Graphs & Tables	E	9	5.1	3.0	3.8	5.2			Fb=0.77 p=0.39
	C	10	2.7	3.5	1.9	2.4			Fw=3.40 p=0.08
									Fi=0.05 p=0.82
Math Concepts	E	9	7.3	5.1	3.2	4.4			Fb=1.07 p=0.32
	C	10	9.0	12.2	7.5	6.9			Fw=1.59 p=0.22
									Fi=0.34 p=0.57
Math Problems	E	9	11.3	11.2	9.7	6.7			Fb=1.38 p=0.26
	C	10	12.9	8.2	15.9	8.6			Fw=0.08 p=0.78
									Fi=1.03 p=0.33
Total Math	E	9	6.9	6.0	3.6	4.2			Fb=2.11 p=0.17
	C	10	8.7	9.2	9.7	6.6			Fw=0.58 p=0.46
									Fi=1.98 p=0.18
Year 3									
Graphs & Tables	E	7	4.9	3.4	3.4	5.7	14.2	8.4	Fb=0.80 p=0.84
	C	6	3.0	2.7	1.3	1.6	16.7	19.5	Fw=7.50 p=0.003*
									Fi=0.82 p=0.79
Math Concepts	E	7	7.6	5.9	3.6	4.9	21.7	25.1	Fb=0.80 p=0.39
	C	6	9.7	15.2	10.5	7.4	27.8	21.6	Fw=6.09 p=0.008*
									Fi=0.11 p=0.90
Math Problems	E	7	9.6	11.5	9.1	7.1	25.7	6.7	Fb=5.58 p=0.04*
	C	6	15.3	8.5	18.5	6.4	36.2	16.4	Fw=16.01 p=0.0001*
									Fi=0.23 p=0.80
Total Math	E	7	5.8	6.0	3.4	4.2	23.0	16.4	Fb=2.92 p=0.12
	C	6	10.1	11.2	12.6	6.0	31.5	16.7	Fw=16.16 p=0.00*
									Fi=0.23 p=0.80

[a] means are given in percentile units
*indicates significance

3. Changes in Student Attitudes

Changes in attitude were measured in each year of the study with a modified version of the Holtzman and Brown Survey and a Perception of Thinking Abilities Scale.

At the end of Year 1, (Table 12), there were significant changes for both groups on achievement anxiety (Fw=4.09 p=0.05) and on the Perception of Thinking Ability Scale (Fw=76.3 p=0.00). At the end of Year 2, (Table 13), both groups continued to score significantly higher than initially (Fw=59.92 p=0.00) and there was a significant difference between groups (Fb=6.39 p=0.02) in favour of the controls across the three testing sessions. At the end of Year 3, (Table 14), the findings concerning thinking ability remained significant (Fw=38.7 p.0.01; Fb=9.07 p=0.01). There was also a significant difference on the general attitude factor (Fb=4.79 p=0.05) in favour of the controls and a significant interaction (Fi=2.96 p=0.05) on the attitudes toward study habits and test taking factors.

4. Behavioural Change

Behavioural change was assessed using the Stony Brook Classroom Observation Code, a teacher behaviour rating scale and also by keeping records of attendance, late arrivals and attrition.

1. Stony Brook Classroom Observation Code

Students were rated in eight areas: absence of behaviours, interference, off task-behaviour, minor motor behaviour, gross motor behaviour, responding to questions, solicitation and request clarification. T-tests were performed on the combined means from both classes where observations were made to compare the experimental and control groups (Table 15).

Table 12

Comparison of Means End of Year 1 Attitude Scales

		Initial		Year 1		
	N	Means	S.D.	Means	S.D.	F Values
General Attitude Towards School	E 12	47.08[a]	12.5	45.08	5.7	Fb=0.57 p=0.46 Fw=0.26 p=0.61
	C 15	44.20	4.1	44.33	7.0	Fi=0.34 p=0.56
Attitude Towards Teacher	E 12	77.17	9.9	78.25	7.2	Fb=0.00 p=0.98 Fw=0.22 p=0.64
	C 15	77.33	7.9	78.20	11.2	Fi=0.00 p=0.95
Study Habits and Test Taking	E 12	102.3	17.1	103.3	18.4	Fb=0.23 p=0.64 Fw=0.11 p=0.74
	C 15	104.7	11.1	105.7	14.1	Fi=0.00 p=0.99
Motivation	E 12	40.08	4.7	41.75	9.3	Fb=0.27 p=0.61 Fw=0.35 p=0.43
	C 15	41.80	7.4	42.53	9.6	Fi=0.05 p=0.82
Academic Interest	E 12	29.42	3.1	29.00	5.5	Fb=0.98 p=0.33 Fw=0.64 p=0.43
	C 15	29.73	9.3	33.07	8.9	Fi=1.05 p=0.17
Need Achievement	E 12	33.58	7.7	34.67	7.0	Fb=0.27 p=0.61 Fw=0.55 p=0.46
	C 15	37.27	6.3	33.73	10.2	Fi=1.96 p=0.17
Achievement Anxiety	E 12	40.83	6.8	37.08	5.9	Fb=0.18 p=0.67 Fw=4.09 p=0.05*
	C 15	41.47	5.5	38.33	9.5	Fi=0.03 p=0.86
Perception of Thinking Ability Scale	E 12	22.67	7.1	36.00	6.0	Fb=0.95 p=0.34 Fw=76.3 p=0.00*
	C 15	24.0	6.4	38.00	4.3	Fi=0.05 p=0.83

*indicates significance

[a]means given as raw scores

Table 13

Comparision of Means End of Year 2 - Attitude Scales

		N	Initial Means	Initial S.D.	Year 1 Means	Year 1 S.D.	Year 2 Means	Year 2 S.D.	F Values
Attitude Toward Education	E	10	44.3[a]	8.3	44.4	5.9	42.6	5.4	Fb=1.22 p=0.28 Fw=0.102p=0.91
	C	10	44.7	4.1	45.6	5.3	47.6	5.1	Fi=1.42 p=0.26
Attitude Towards Teachers	E	10	77.3	11.3	77.6	7.4	83.9	12.9	Fb=0.04 p=0.84 Fw=3.01 p=0.06
	C	10	77.8	10.9	77.1	13.1	81.5	6.4	Fi=0.18 p=0.83
Study Habits & Test Taking	E	10	98.7	14.5	101.6	19.9	103.2	9.3	Fb=1.69 p=0.25 Fw=0.14 p=0.88
	C	10	109.0	9.6	109.0	13.5	103.8	13.9	Fi=0.99 p=0.38
Academic Motivation	E	10	40.7	5.6	39.9	9.0	40.2	6.2	Fb=1.54 p=0.23 Fw=0.05 p=0.95
	C	10	43.1	6.5	44.5	10.4	43.0	7.5	Fi=0.19 p=0.83
Interest in Academics	E	10	29.1	3.1	29.2	5.4	30.1	5.8	Fb=1.87 p=0.19 Fw=0.78 p=0.47
	C	10	30.7	8.2	35.3	7.3	31.2	9.7	Fi=1.02 p=0.37
Achievement Anxiety	E	10	40.7	7.0	37.2	4.1	41.0	4.3	Fb=0.17 p=0.69 Fw=1.63 p=0.21
	C	10	40.6	3.8	37.2	11.0	38.6	7.9	Fi=0.23 p=0.79
Need Achievement	E	10	32.5	5.1	34.4	6.8	32.1	5.9	Fb=1.17 p=0.29 Fw=1.67 p=0.20
	C	10	38.0	5.9	32.7	8.9	34.9	7.8	Fi=0.50 p=0.61
Perception of Thinking Ability Scale	E	10	21.0	5.1	34.8	5.9	37.4	4.3	Fb=6.39 p=0.02* Fw=59.9 p=0.000*
	C	10	24.5	6.1	39.7	4.1	39.0	4.4	Fi=0.55 p=0.58

[a] means given as raw score

*indicates significance

Table 14
Comparison of Means End of Year 3 - Attitude Scales

		N	Initial Means	Initial S.D.	Year 1 Means	Year 1 S.D.	Year 2 Means	Year 2 S.D.	Year 3 Means	Year 3 S.D.	F Value
Attitude Towards Education	E	7	41.8[a]	8.4	41.5	4.5	41.7	5.6	42.2	5.3	Fb=4.79 p=0.05*
											Fw=0.06 p=0.98
	C	6	45.5	5.2	47.3	4.5	47.0	3.8	46.0	7.6	Fi=0.14 p=0.93
Attitude Towards Teacher	E	7	77.1	12.3	76.0	7.7	81.3	11.5	80.7	13.9	Fb=0.26 p=0.62
											Fw=0.53 p=0.67
	C	6	81.0	10.9	80.6	12.2	81.6	4.3	82.1	15.3	Fi=0.20 p=0.89
Study Habits & Test Taking	E	7	99.9	10.7	95.3	16.5	103.4	8.6	93.3	8.6	Fb=1.53 p=0.24
											Fw=0.86 p=0.47
	C	6	106.5	7.7	112.3	13.4	98.2	14.5	103.3	21.8	Fi=2.96 p=0.05*
Motivation	E	7	40.4	4.2	38.3	7.9	38.7	5.6	39.9	7.9	Fb=1.54 p=0.24
											Fw=0.37 p=0.77
	C	6	43.8	7.5	46.5	10.5	41.6	8.8	43.6	12.6	Fi=0.57 p=0.64
Academic Interest	E	7	29.8	2.7	29.0	1.7	28.4	4.9	27.0	5.4	Fb=0.82 p=0.39
											Fw=2.42 p=0.08
	C	6	30.8	7.4	36.8	8.8	28.5	10.5	29.8	11.7	Fi=1.62 p=0.20
Need Achievement	E	7	31.8	5.9	35.0	4.4	34.7	3.9	32.8	5.6	Fb=0.21 p=0.65
											Fw=0.24 p=0.86
	C	6	37.3	6.3	30.8	10.5	34.8	9.9	36.5	10.9	Fi=1.41 p=0.26
Achievement Anxiety	E	7	41.6	8.0	37.9	4.1	39.4	3.6	37.2	5.0	Fb=0.10 p=0.76
											Fw=0.83 p=0.49
	C	6	41.3	3.8	37.2	13.4	39.8	9.3	41.2	7.4	Fi=0.34 p=0.79
Perception of Thinking Ability	E	7	20.7	5.5	35.1	6.8	37.7	3.9	33.1	5.1	Fb=9.07 p=0.01*
											Fw=38.7 p=0.00*
	C	6	23.0	4.4	41.5	4.0	41.0	3.6	40.2	5.3	Fi=0.77 p=0.52

*indicates significance

[a] means given as raw score

Table 15

Means for Stony Brook Observational Data

Rated on	E (N=11) Means	S.D.	C (N=14) Means	S.D.	t test	p value
Year 1						
Absence of Behavior	49.5[a]	7.7	46.9	7.3	t= 0.87	p=0.39
Interference	4.5	3.3	5.7	5.6	t=-0.65	p=0.51
Off Task	3.0	3.4	4.6	4.9	t=-0.88	p=0.38
Minor Motor	2.4	1.7	4.0	3.7	t=-1.30	p=0.21
Gross Motor Standing	1.1	0.8	1.7	2.5	t=-0.81	p=0.43
Responding to Question	0.7	1.3	1.0	1.2	t=-0.70	p=0.49
Solicitation	1.3	1.3	1.6	1.1	t=-0.51	p=0.61
Request Clarification	2.05	4.4	0.2	0.2	t= 1.55	p=0.13
	E (N=9) Means	S.D.	C (N=11) Means	S.D.	t test	p value
Year 2						
Absence of Behavior	50.2	7.6	51.7	8.8	t=-0.41	p=0.68
Interference	5.8	6.0	6.1	4.7	t=-0.11	p=0.92
Off Task	1.9	2.2	0.6	0.8	t= 1.84	p=0.08
Minor Motor	3.3	2.2	5.2	3.8	t=-1.30	p=0.19
Gross Motor Standing	0.7	1.0	0.1	0.3	t= 1.77	p=0.09
Responding to Question	0.1	0.2	1.7	3.1	t=-1.57	p=0.13
Solicitation	0.4	1.0	0.6	1.1	t=-0.52	p=0.61
Request Clarification	1.3	2.9	0.7	1.4	t= 0.61	p=0.55
	E (N=7) Means	S.D.	C (N=5) Means	S.D.	t test	p value
Year 3						
Absence of Behavior	58.0	9.9	59.6	3.8	t=-0.34	p=0.74
Interference	3.7	3.4	2.2	1.8	t= 0.91	p=0.38
Off Task	4.2	6.3	0.4	0.5	t= 1.35	p=0.21
Minor Motor	1.1	1.2	1.0	0.7	t= 0.23	p=0.82
Gross Motor Standing	0.0		0.0		----------	
Responding to Question	3.0	1.2	0.8	1.8	t= 2.61	p=0.02*
Solicitation	2.6	1.3	0.8	1.1	t= 2.50	p=0.03*
Request Clarification	0.0		0.0		----------	

*indicates significance

[a]means are frequency of response per 16 min. period.

There were no significant differences between groups on any area in Years 1 and 2. In Year 3 the experimental group asked significantly more questions ($t=2.5$ $p=0.03$), and responded to more questions ($t=2.61$ $p=0.02$) than did the controls.

2. Teacher Behaviour Ratings

Items on the teacher behaviour rating scale (Appendix A), were grouped into three factors: class preparation, (questions 1 - 5), verbal behaviours, (questions 6 - 10), and behaviour in class (questions 11 - 16). Mean ratings were analyzed separately for each class in which the teacher rated the students and also collapsed over the three classes. Table 16 presents the means for each group and t-test values, comparing all group members. Significant differences were found on the class preparation factor in Year 3 only ($t=2.23$ $p=0.04$, math; $t=2.1$ $p=0.05$, shop; $t=3.46$ $p=0.05$, combined), and when data from all three classes are combined for class behaviour as well ($t=2.11$ $p=0.05$). These differences were in favour of the control group.

3. Attendance and Attrition

Attendance records and reasons for attrition from the project were examined in order to determine if there were differences between the two groups on these variables.

The number of days absent and the number of times students were late were recorded for each group to investigate the hypothesis that the program would influence global behaviours such as attendance. Table 17 presents the mean scores and t-test values. There were no significant differences between the two groups on either number of days absent or days late.

Table 16
Teacher Ratings of Student Behavior

Year 1	Means E=12	C=14	t-test	p value
Language Arts				
Class Prep	12.3	12.1	t= 0.14	p=0.88
Verbal Behavior	18.4	20.0	t=-1.03	p=0.30
In Class Behavior	11.7	12.9	t=-1.57	p=0.13
Math				
Class Prep	13.3	12.5	t= 0.46	p=0.65
Verbal Behavior	19.0	18.0	t= 0.61	p=0.55
In Class Behavior	11.7	12.8	t=-1.30	p=0.19
Shop				
Class Prep	10.3	12.4	t=-1.40	p=0.19
Verbal Behavior	18.3	19.4	t=-0.62	p=0.54
In Class Behavior	12.4	11.9	t= 0.93	p=0.36
Collapsed Scores				
Class Prep	34.9	37.0	t= 0.28	p=0.60
Verbal Behavior	54.8	55.5	t=-0.28	p=0.78
In Class Behavior	35.7	37.6	t=-1.55	p=0.13
Year 2	E=8	C=9		
Language Arts				
Class Prep	10.3	13.1	t=-1.50	p=0.16
Verbal Behavior	16.3	18.4	t=-0.83	p=0.42
In Class Behavior	9.9	10.2	t=-0.21	p=0.83
Math				
Class Prep	10.3	10.9	t=-0.44	p=0.67
Verbal Behavior	16.8	19.2	t=-1.11	p=0.28
In Class Behavior	10.6	10.5	t= 0.06	p=0.97
Shop				
Class Prep	10.6	9.2	t= 0.75	p=0.47
Verbal Behavior	16.4	16.4	t=-0.04	p=0.97
In Class Behavior	10.4	11.2	t=-0.68	p=0.51
Collapsed Scores				
Class Prep	31.8	34.3	t=-0.73	p=0.47
Verbal Behavior	49.4	51.8	t=-0.40	p=0.70
In Class Behavior	30.9	32.2	t=-0.52	p=0.61
Year 3	E=7	C=6		
Language Arts				
Class Prep	15.7	13.5	t= 1.13	p=0.28
Verbal Behavior	18.4	16.8	t= 0.78	p=0.43
In Class Behavior	12.7	11.0	t= 1.52	p=0.11
Math				
Class Prep	13.4	9.0	t= 2.23	p=0.04*
Verbal Behavior	17.4	13.5	t= 1.60	p=0.14
In Class Behavior	11.6	10.3	t= 0.89	p=0.39
Shop				
Class Prep	8.1	6.2	t= 2.10	p=0.05*
Verbal Behavior	14.3	11.8	t= 1.10	p=0.28
In Class Behavior	10.6	8.5	t= 2.06	p=0.07
Collapsed Scores				
Class Prep	37.3	28.7	t= 3.46	p=0.005*
Verbal Behavior	50.1	42.1	t= 1.90	p=0.08
In Class Behavior	34.9	29.8	t= 2.11	p=0.05*

NOTE: A lower mean score indicates better behavior

* indicates significance
all means reported are raw scores

Table 17

Absences and late Arrivals Over Three Years

		N	Means	S.D.	t test	p value
Year 1						
Days Absent	E	11	18.5	14.6	t=-0.71	p=0.49
	C	15	23.2	17.9		
Days Late	E	11	9.9	8.5	t=-1.15	p=0.26
	C	15	14.3	10.5		
Year 2						
Days Absent	E	8	15.9	12.6	t= 0.59	p=0.56
	C	9	12.8	9.2		
Days Late	E	8	9.0	5.8	t=-0.89	p=0.39
	C	9	15.6	20.5		
Year 3						
Days Absent	E	7	12.7	5.3	t= 0.27	p=0.79
	C	6	11.5	10.7		
Days Late	E	7	10.1	12.4	t= 1.09	p=0.29
	C	6	4.3	3.9		

Attrition from the project was for one of two reasons. Students either moved into academic programs at other schools, or left school entirely. No student left the Instrumental Enrichment program who remained in the project school.

At the end of the second year and beginning of the third year of the study, thirteen (13) students had left the study. In the experimental group, two (2) students had left the school entirely and five (5) students had transferred to other schools. In the control group, all six (6) students who had left the study dropped out of school.

The reasons for attrition were related to three variables to examine whether attrition from the groups was random. The variables chosen were attendance, reading scores on the Woodcock-Johnson and Mathematics scores on the Woodcock-Johnson. The Reading and Mathematics scores were analyzed in relation to attrition as the initial means changed with each re-analysis of the data (Tables 8 and 10).

To investigate whether attendance was related to the likelihood of remaining in school, the attendance records of the experimental and control students were rank ordered and divided into high and low absentees. A chi-square analysis was performed to see whether high and low attendance predicted

attrition. A chi-square analysis (Table 18) indicated a relationship between high absentee rates and leaving school for the control group but not for the experimental group (x^2=16.2, df=7, p=0.025). Students in the experimental group with high absentee rates were equally likely to leave or stay.

Table 18

Chi-Square Table Relating Absentee Rate to Attrition

		Absent from School	
		Low	High
Experimental	Drop Out	0	2
	Stay in School	7	3
Control	Drop Out	0	6
	Stay in School	5	2

To examine the relationship between reasons for attrition and reading scores, students were rank ordered on their initial scores on the Woodcock-Johnson Reading Cluster, and classified into high and low scoring groups. There were three attrition categories: 1) "drop-out" referred to those students who left school entirely; 2) "stay" referred to those students still in the project; and 3) "move on" referred to those students who transferred to academic programs in other schools.

A chi-square analysis (Table 19), comparing reason for leaving with high and low scores on the Woodcock-Johnson Reading Cluster was significant (x^2=17, df=5, p=0.005). It indicated that students in the experimental group who had high initial scores were most likely to leave the study and move on to academic programs than were those with low scores.

Table 19

Effect of Reason for Attrition on Woodcock-Johnson Reading Scores

		Reading Scores	
		Low	High
Experimental	Dropout	2	0
	Stay	6	1
	Move on	0	5
Control	Dropout	3	3
	Stay	5	5
	Move on	0	0

For the control group, students with high and low scores stayed or dropped out of school at equal rates.

A similar chi-square analysis (Table 20) comparing students with high and low scores on the Woodcock-Johnson Mathematics Cluster with attrition reasons was also significant (x^2=12 df=5 p=0.05). As with the analysis of reading scores, experimental students scoring high in mathematics were more likely to leave the project to attend another school than were those with low scores. For the control group no such relationship was found.

Table 20

Effect of Reason for Attrition on Woodcock-Johnson Mathematics Scores

		Mathematics Scores	
		Low	High
Experimental	Dropout	1	1
	Stay	6	1
	Move on	1	4
Control	Dropout	3	3
	Stay	5	5
	Move on	0	0

5. Teacher Attitudes

A questionnaire on teacher attitudes concerning non-achievers was given to teachers before the inservice sessions and again afterwards. There was an increase in the number of teachers returning the questionnaire [22% (N=11) in 1981, 42% (N=21) in 1983].

All teachers who returned the questionnaire except one in both 1981 and 1983 knew about the Instrumental Enrichment Program at the project

school. In 1981 (at the beginning of the program), 73% believed such a program could change negative attitudes toward learning. In 1983, 91% responded that this was a potential benefit. The percentage of teachers believing that conduct and emotional problems could be changed also increased between 1981 and 1983. There were no differences between 1981 and 1983 in other areas that teachers believed the program might affect. Table 21 presents the percentage of teachers who believe the Instrumental Enrichment program could affect selected areas.

Teachers were also asked to rate any changes they had personally observed that they believed could be attributed to the Instrumental Enrichment program. It is important to note that teachers did not necessarily know which students were in the Instrumental Enrichment program and which were controls. Table 21 gives the percentage who believed they had observed changes in eight designated areas. Change from 1981 to 1983 were greatest in the target Instrumental Enrichment areas of thinking skills and learning strategies. Nine percent observed changes in 1981 while twenty-nine percent had observed such changes in 1983. Similarly, nine percent had observed changes in learning strategies in 1981 and thirty-three percent had in 1983. While teachers stated that they believed Instrumental Enrichment could affect conduct and emotional problems, few reported any observed changes.

Beliefs as to causes for failure in normally intelligent children also changed between 1981 and 1983 (Table 22). Teachers were asked to rank order what they believed were probable factors for failure in normally intelligent children and which factors they believed were responsive to remediation. In 1981 teachers believed lack of motivation was the most likely cause of failure. In 1983 they ranked negative attitude toward learning more

Table 21

Analysis of Teacher Attitudes Concerning Instrumental Enrichment

	I.E. program can make a difference for failing students in these areas		I have observed changes in students in the following areas	
	Initial N=11	Year 2 N=21	Initial N=11	Year 2 N=21
Negative Attitude Toward Learning	73%	91%	36%	29%
Lack of Motivation	73%	71%	27%	24%
Poor Reading	46%	48%	9%	19%
Poor Math Skills	36%	43%	9%	19%
Poor Thinking Skills	81%	76%	9%	10%
Poor Learning Strategies	81%	86%	9%	33%
Conduct Problems	27%	48%	18%	19%
Emotional Problems	18%	43%	9%	14%
No Changes Observed	--	--	27%	19%

Table 22

Analysis of Teachers Attitudes Concerning Non-Achievers

Question	Source of Difficulty	Teacher Ranking Initial N=11	Year 2 N=21
Probability of Area Causing Failure in School	1 Lack of Motivation	1[1]	2
	2 Negative Attitude Toward School	2	1
	3 Poor Reading Skills	3	4
	4 Poor Thinking Skills	4	3
Which area of failure can be changed	1 Negative Attitude Toward Learning	1	2
	2 Lack of Motivation	2	1
	3 Poor Reading Skills	3	3
	4 Poor Math Skills	4	5
	5 Poor Thinking Skills	6	4

[1]A rank of 1 indicates most likely or important

likely than lack of motivation. Similarly, in 1983 poor reading skills were ranked before poor thinking skills as a probable cause. In 1983 teachers ranked poor thinking skills ahead of poor reading skills.

Teacher rankings concerning areas of failure that can be changed differed between 1981 and 1983. Negative attitudes and lack of motivation were ranked one and two in terms of ease of change in 1981 and two and one in 1983. Ranking for ease of change in reading, mathematics and thinking skills also shifted from 1981 to 1983. In 1982 both academic skills (mathematics and reading) were ranked as easier to change than thinking skills. In 1983 thinking skills were ranked easier to change than mathematics.

It is important to note that different teachers may have returned the questionnaires before and after the inservice presentations.

C. SUMMARY OF RESULTS:

Students were reassessed in four areas to evaluate the effects of Instrumental Enrichment. There were:

1) reasoning and intelligence;

2) achievement;

3) attitudes;

4) behaviour.

In addition, teachers in the project school were surveyed before and after inservice sessions to ascertain their beliefs and changes in attitudes toward low achieving students and the experimental program.

On the reasoning and intelligence measures both groups showed gains over time on the Woodcock-Johnson Reasoning Cluster, Raven's Standard Progressive Matrices, Set Variations II and Numerical Progressions.

Only at the end of Year 1 did the experimental group score significantly better than the control group on Numerical Progressions.

Achievement changes were assessed in the areas of reading and mathematics. Both groups showed significant gains over time with reading tests. At the end of the first year only the experimental group scored significantly higher than the control group on the reading subtest of the Woodcock-Johnson. On the Canadian Test of Basic Skills Reading subtest, the control group outperformed the experimental group at the end of Year 3. Both groups showed increased scores for vocabulary.

On the mathematics tests both groups improved over time. Where there were differences in the groups (Years 2 and 3) they were in favour of the control group.

The attitude measures found few differences between groups. Those differences that did occur were in favour of the control group. Similarly few differences in behaviour were noted on either measure.

The attrition and attendance results indicated that while there were no differences in attendance rates between the two groups, students in the control group with low attendance rates were more likely to leave school than were control students with high attendance rates. A similar relationship was not found for the experimental students.

In addition, students in the experimental group who scored high initially on the reading and mathematics subtests were more likely to transfer to other schools with academic programs than were students with low scores or control students generally.

The latter findings concerning differential attrition from the two groups indicate that the retest data must be viewed with caution.

Attitudes of teachers became more positive between the initial and final survey. Their attitudes towards reason for failure and their beliefs about the locus of effect of the experimental program both changed.

V. DISCUSSION

One interpretation of the results of this study is that the Instrumental Enrichment program was not effective in changing thinking skills, achievement and attitudes of low achieving adolescents. From a simple perusal of the means it would in fact appear that the program was detrimental as the control group scored significantly higher in several areas by the end of Year 3.

A second interpretation for these findings and one borne out by the attrition analyses is that the experimental program's effect was not directly evident on the retest means but was evident on changes in the composition of the groups available for retesting. The retest means must be viewed with caution as attrition from the project was influenced by the experimental program. This finding highlights the need to re-examine the composition of groups over time. Longitudinal studies evaluating the effects of a program promoting change run the risk of losing the students who benefitted most and hence the scores of the remaining students may lead to an underestimation of the effect of the program. Future studies evaluating longitudinal programs should attempt to retest all students in the project, including those who transfer schools, leave school entirely, or leave the project for other reasons. This is costly but it is critical to fully understanding the effects of the program.

The lack of significant differences and significant change scores on the evaluation measures makes it difficult to know where and why the Instrumental Enrichment program was having an effect. It is extremely

difficult to find measures that are sensitive enough to sample the effects. For example, the Canadian Test of Basic Skills (C.T.B.S.) was chosen to assess achievement as it was used most often by the School Board of the project school. So few significant changes were found on this test, one might assume the students had not learned anything in three years. More likely, the test was not sampling what was being taught, that is, it does not match the curriculum and thus does not reflect what has been learned.

Similarly, there is much anecdotal evidence that students in the experimental program believed the program was affecting their attitudes but few attitude changes were found on the measures used. The fact that the students with initially high scores in reading and mathematics were more likely to transfer to academic programs after one year than were similar control students, may indicate that the Instrumental Enrichment program did affect their attitudes towards themselves and learning.

It is important that future studies also assess changes in non-intellective factors such as need for mastery, frustration tolerance, fear of failure, and locus of control, as these may be preparatory to change in other areas. A more sophisticated observation system that looked for these and other microchanges would provide a clearer picture of what was happening. Changes that did occur on the Stony Brook Classroom Observation Code were the "microchanges", small behavioural changes that the authors of the program believe will be affected by the program. Also observations of students in the Instrumental Enrichment class, as well as other classes, would have allowed us to see if changes in behaviour were beginning in that class and then generalizing to other areas.

Future studies would benefit from criterion referenced tests and more sensitive attitudinal and observation measures. In addition, using a multiple base line technique would help clarify the effects of retesting and attention, and provide a base line for change rates before and after the program.

A major problem with collecting adequate measures for evaluation is the amount of testing time the students and administration would tolerate. We were constrained by time,as students had to miss classes in order to be tested and this created anxiety and sometimes outright anger. Thus, the ideal for data collection may be compromised by the realities of the school situation, something that must be considered in designing evaluation research.

The size of the sample in this study was very small, as we were limited to one trained itinerant Instrumental Enrichment teacher when the project began. Having only one experimental class created two problems: First, the loss of only a few students shifted the means and changed the composition of the sample significantly. Second, by having only one teacher, the effect of the teacher cannot be separated from the effect of the experimental program. The teacher involved was an extremely dynamic, concerned person, who might have elicited similar changes regardless of the program used. However, anecdotal reports from other teachers at the project school indicated that the effects were not due simply to the teacher. Two other teachers with very different styles began using the program while the project was in progress and reported positive results from it. Unfortunately, there is no objective data on these classes or teachers. Future studies would benefit from evaluation of several classes and teachers.

The results of the Haywood et al (1982) study point out the need to not only evaluate changes in students but to study the characteristics of effective Instrumental Enrichment teachers. An understanding of the characteristics will allow for more effective teacher training. Also, by analyzing the characteristics of effective Instrumental Enrichment teachers, we may gain insight into the characteristics of effective teachers generally. Many people have argued Instrumental Enrichment is a philosophy of education as well as a remedial approach.

As this study progressed it became evident that there was a need not only to evaluate the changes in students but also changes in teachers. The project teacher reported that her style and way of teaching had changed as a result of teaching this program. Other teachers have reported similar feelings. Thus,future studies should evaluate the effect of teaching this program on changes in both the students and the teachers.

One question asked in this study was the effect of inservice presentations on teacher attitudes. While positive shifts in teacher attitude were found it is difficult to attribute the shifts to the inservice presentations alone. The counsellors, administration and some teachers became very excited about the program during the first year and before any evaluation data was available, the administration approved the training of one of their teachers in Instrumental Enrichment and one of their counsellors in Feuerstein's assessment technique, the Learning Potential Assessment Device (Feuerstein, 1979). In the fall of 1982, two additional classes were implemented at the project school. Since that time several additional teachers have received training and new clasees have been implemented. Interest in the program as a result of this project has spread rapidly and

over three hundred (300) teachers from around Alberta have been trained to teach Instrumental Enrichment. There appears to be an intuitive appeal to teachers apart from the results of evaluative research on this program.

VI. CONCLUSIONS

Low achieving adolescents participating in an Instrumental Enrichment program appeared to benefit from it. Those with the highest mathematics and reading levels were more likely to move on to academic programs than were those with lower levels or the control group generally. They were also more likely to stay in school than were students in the control group. While high absentee rates predicted leaving school for the controls, it did not do so for the experimentals. Teacher attitudes toward the program were extremely positive and the program has continued and expanded in the project school and other Calgary schools as a result of interest in this study.

Further investigations of this program are warranted. Future studies should attempt to reassess all students including those who leave the project for whatever reason, as attrition from such programs may not be random.

More sensitive criterion referenced tests should be used. Non intellective factors, attitudes and behaviour should be assessed to ascertain micro-changes not evident in standard batteries. If possible, multiple base line designs would be desirable.

Future investigations should involve a larger sample size with several classes and several different teachers. This would allow not only a separation of teacher style from the effects of the experimental program, per se, but would also allow an investigation of the characteristics of effective Instrumental Enrichment teachers.

Lastly, an investigation of changes in both the students and the teachers would allow an indepth understanding of the specific effects of this program.

VII. REFERENCES

VII. REFERENCES

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APPENDIX A

TEACHER BEHAVIOUR RATING SCALE

	Almost Always	Usually	50-50	Seldom	Almost Never	Much More Often	More Often	Average	Less Often	Much Less
1. Student asks for clarification on tests, assignments etc.	1	2	3	4	5	1	2	3	4	5
2. Student speaks out of turn	1	2	3	4	5	1	2	3	4	5
3. Student answers or speaks before thinking	1	2	3	4	5	1	2	3	4	5
4. Student works well independently	1	2	3	4	5	1	2	3	4	5
5. Student refuses to work in class	1	2	3	4	5	1	2	3	4	5
6. Student bothers other students (talking, poking, etc.)	1	2	3	4	5	1	2	3	4	5
7. Student asks to leave room (to go to washroom etc.)	1	2	3	4	5	1	2	3	4	5

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Name: _____ Date: _____

Subject: _____

Level: _____

Please rate _____ on the following behaviors. Rate each behavior twice: Once in terms of how often the behavior occurs and once in comparison to other students in the class.

For example, on item one "Student hands in assignments" if student hands in assignments half of the time circle "3". If this is much more often than other students in your class circle "1". If it is about average circle "3" etc..

	Frequency of Behavior					Compared to Other Students				
	Almost Always	Usually	50-50	Seldom	Almost Never	Much More Often	More Often	Average	Less Often	Much Less
1. Student hands in assignments	1	2	3	4	5	1	2	3	4	5
2. Student hands in assignments on time	1	2	3	4	5	1	2	3	4	5
3. Student attends class	1	2	3	4	5	1	2	3	4	5
4. Student is on time for class	1	2	3	4	5	1	2	3	4	5
5. Student is prepared for class (has books, pens, notebooks etc.)	1	2	3	4	5	1	2	3	4	5
6. Student participates in class discussion	1	2	3	4	5	1	2	3	4	5
7. Student asks appropriate questions	1	2	3	4	5	1	2	3	4	5
8 Student asks inappropriate questions (off-topic, irrelevant)	1	2	3	4	5	1	2	3	4	5
9. Student refuses to answer when called upon	1	2	3	4	5	1	2	3	4	5

APPENDIX B

CHARACTERISTICS OF FEUERSTEIN'S INSTRUMENTAL ENRICHMENT PROGRAM

CHARACTERISTICS OF FEUERSTEIN'S INSTRUMENTAL ENRICHMENT PROGRAM

Excerpt from Instrumental Enrichment, by Reuven Feuerstein,
Baltimore: University Park Press, in press.

Program Characteristics	Instrumental Enrichment Program
General goal:	To render the culturally deprived retarded performer more modifiable in his direct exposure to sources of stimuli and in his encounter with academic and life experiences.
Specific sub-goals:	Correction of deficient cognitive functions; Acquisition of vocabulary, concepts, operations, and relationships relevant to program; Formation of habits; Production of intrinsic motivation; Creation of insight and reflective thinking; Shift from role of passive recipient and reproducer of information to that of active generator of new information.
Target population:	Ages 10 to adulthood for culturally deprived. Ages 8 to adulthood for normal with specific problems.
Level of functioning:	40 IQ to 90 IQ for culturally deprived. Certain learning disabilities for normal or gifted Certain cognitive deficiencies
Minimal conditions:	Accessible to verbal or other kinds of information; Minimal visual-motor functioning; Accessible to training in elementary graphic activity to be used in paper-pencil exercises.
Level of scholastic achievement:	Irrelevant for application. Certain instruments accessible to total illiterates.
Types of motivation:	Task-intrinsic; Socially reinforced through peer and teacher interaction.

	Accessible for many scholastically unmotivated children; Appropriate for inhibited young adults who are not willing to accept regression to low level required for acquisition of basic school skills.
Etiology and pathological entity:	Culturally and socially disadvantaged retarded performers; The culturally different; EMR; Retarded functioning with organic or genetic sub-strata; Unorganized, unmotivated normal individuals who require the acquistion of work habits, strategies, and insight. Perceptual deficits and learning disabilities (L.D.) Traumatic, organic syndromes.
Settings:	Classroom; resource room. Individual tutorial setting. Prescriptive remedial setting. Extra-curricular setting. Under certain conditions, self-administration.
Teachers:	Especially trained for Instrumental Enrichment. No other formal academic pre-requisites essential.
Optimal time framework:	Three to five hours weekly, at spaced intervals.
Scholastic framework:	Complementary to regular curriculum. Complementary to content learning or instruction in basic school subjects and mastery of skills such as reading and mathematics for those with learning disabilities. Extra-curricular material for settings outside of schools.
Nature of materials:	Paper-and-pencil exercises. Divided into instruments, each of which focuses on a particular cognitive function but addresses others as well.

Rhythm of work:	Contingent upon setting. In classroom, pace regulated by mastery, with individualized attention, as necessary. In tutorial settings, individualized and flexible.
Nature of peer interaction:	Cooperative definition of problem; Participation in divergent proposals for solutions; Group discussions for insightful interpretation of IE activities generally, and specific tasks; Peer-assisted interactions.
Interaction with teacher:	Presentation of task; explanation of terms; preparation for independent work; exploration of processes and strategies; orienting; producing insightful, reflective thinking; teaching specific content-related elements necessary for IE; addressing specific deficient cognitive functions and anticipated difficulties in the tasks (See the list of deficient cognitive functions, the cognitive map and the sub-goals of the program); producing motivation by means of reinforcement initiating peer interaction; and producing bridging to content areas and life at large.
Nature of exercises:	Content-free in that content is not goal, per se, but a carrier for differential focus on cognitive functions to be corrected, developed and enhanced.
Nature of activity:	Discovery, learning and repetitious application in varied situations of relationships, rules, principles, operations, strategies, and other pre-requisites of adequate cognitive functioning.
Nature of sequence:	Each instrument graded in difficulty, with tasks becoming progressively more complex in their presentation. Repetition of principles and operations in various situations with orientation to rules and strategies which requires investment for solution.

	changes in teacher's perception of the child; in his evaluation and expectations of the child's modifiability; in his attitude regarding the capacity of the retarded performer; in lessened use of the concrete in favor of more abstract; in process rather than product orientation.
	Knowledge of cognitive structure may make teachers more sensitive to aspects of teaching necessary for changes in both cognitive and personality structures or dimensions.
Child:	Increased willingness to cope with school material; increased motivation and school attendance; Heightened self image.
Parents:	Exposed to success of the child, parents may modify their levels of expectation and image of the child.
Administrative decisions on program:	Through regular decision-making channels for classroom implementation. Teacher, educational counselor, psychologist or educational supervisor for individual, remedial work or prescriptive teaching.
Budget:	From education funds. Cover the cost of material, training and in-service supervision and consultation.
Production and distribution of materials used in program:	IE materials are disseminated only to teachers who have received training. Material is not bound, but distributed to child page by page. Material is protected by international copyright.

Type of feedback		Self-corrective devices in some instruments. Teacher assists in exploring nature of process and in interpretation of micro-changes. Mutual feedback through peer interaction. Self-criticism, with the development of criteria and autonomy.
Reinforcement:		Strong task-intrinsic motivation developed with activity. Teacher's reinforcement directed to creating student understanding of his accomplishments.
Evaluation:		
	Teacher:	Student's efficiency in handling tasks themselves. Student's mastery and facilitation of transfer to other, similar tasks, including summary pages. Student's spontaneous use of learned rules and strategies in other subject matter or Instrumental Enrichment materials.
	Child:	Self-evaluation on objective measurable criteria such as speed, accuracy, positive responses, decrease in impulsivity as evidenced by decrease in erasures, etc. Self-evaluation on subjective reports, feedback from teachers and peers, and evaluations of other teachers.
	Program:	Cognitive changes; effects on school achievement; effects on adaptation; effect on school attendance; effect on behavior in other classes and in public, communal areas.
Services given to teacher:		Training in theory and practice of IE; in-service field training and consultation during classroom visits; orientation; workshops after initial training in didactics and implementation. Lectures on the culturally deprived retarded performer, non-intellective factors in the program, etc
Spillover effects of program:		
	Teacher:	Training and experience with IE affect

APPENDIX C

DESCRIPTION OF CONTENT OF PROGRAM

THE CONTENT OF THE INSTRUMENTAL ENRICHMENT PROGRAM

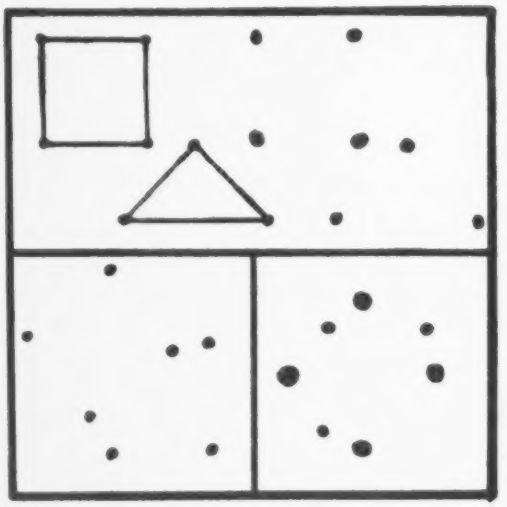
The I.E. program is taught in various schools (ages 10 to adulthood) as part of the general curriculum. The three-year program (which is taught for 3 - 5 periods per week) is presented as a supplement to the general curriculum. The content of the program includes the following:

JUST A MINUTE ...

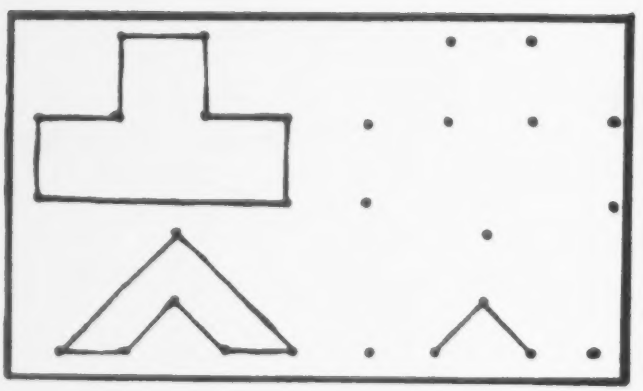
LET ME THINK !

1. The Organization of Dots

This is the first unit in the program. Within each frame the shapes specified in the model have to be reproduced by connecting the appropriate dots.



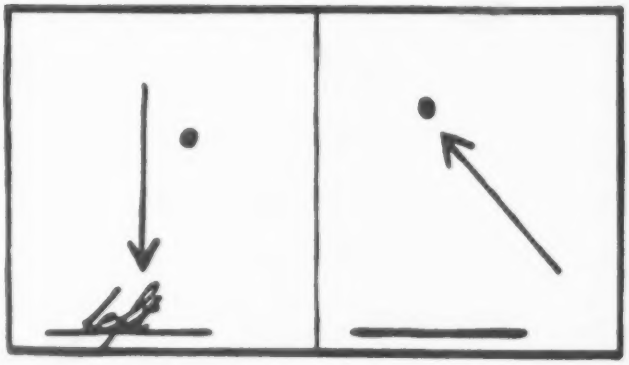
The student is asked to work systematically and accurately. He has to figure out the rules of organization and follow them. While he works on the task, the student generates hypotheses, and forms strategies which are based on these hypotheses.

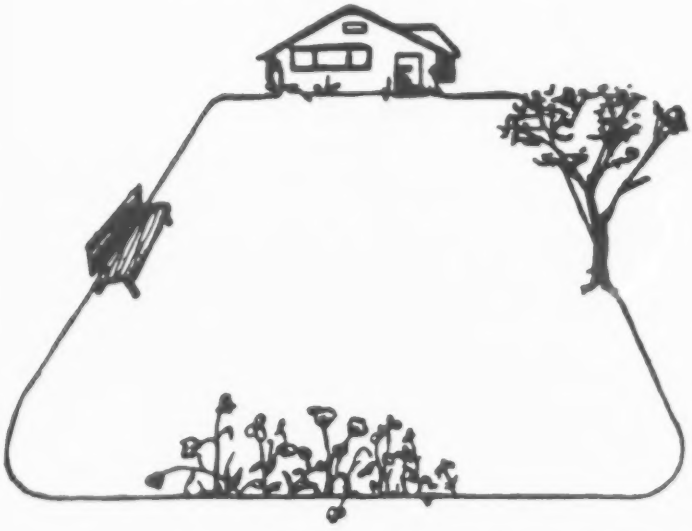


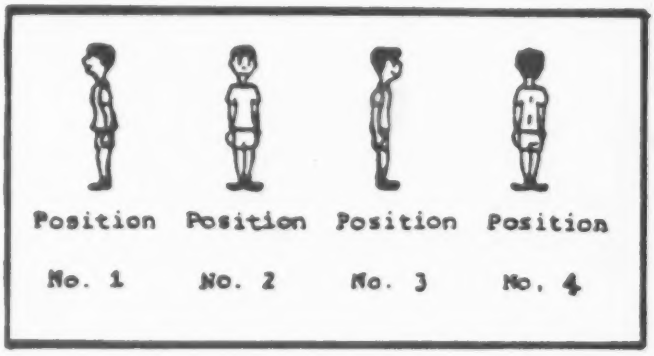
2. Orientation in Space I.

The unit is designed to develop in the learner a differentiated flexible, and representational spatial system of reference. Other objectives include the development of a system of spatial relations; and the reduction of egocentricity.

Where is the dot in relation to the arrow?







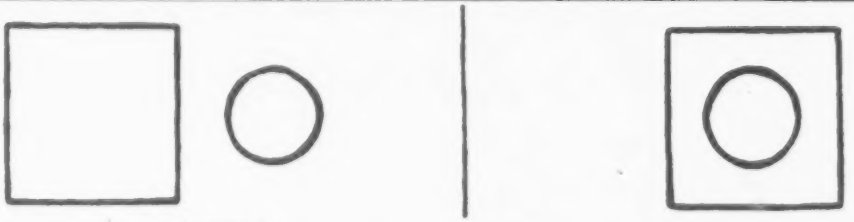
III. In which position is the boy?

Object	Position in Relation to the Boy	Position
The house	front	
The tree	left	
The bench	back	
The flowers	right	
The bench	right	

3. Comparison

This Instrument is concerned with the development of spontaneous comparative behavior. The individual is asked to compare and to orient his perception toward the relevant dimensions for comparison which are indicated by the instructions throughout the instrument. The students are asked to make several comparisons on the basis of characteristics such as size, shape, color, direction, etc. While working on the problems, students are asked to consider relevant (vs. irrelevant) information.

Indicate what is common to each pair of pictures and the differences between them.



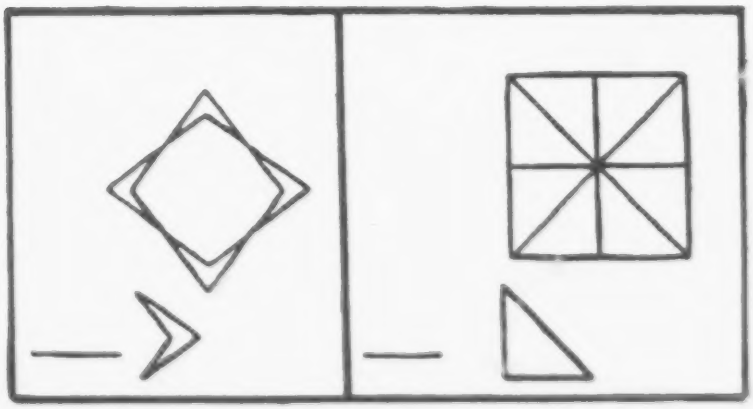
Common: _____

Different: _____ Different: _____

4. Analytic Perception

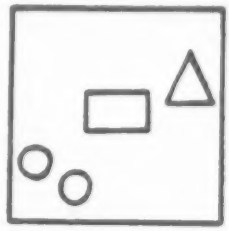
This instrument attemts to develop the ability to analyze an object or an event in a variety of ways according to specific needs. In addition, students are trained to be accurate and precise in their perception of incoming information. Some of the other functions that are emphasized throughout the unit are systematic search, conservation of constancy, temporal and opinional relationship, discrimination and hypothesis testing.

On each line, indicate the number of times the section next to it appears in the design.



5. Instructions

This unit illustrates how to interpret and follow instructions. The task requires decoding verbal instructions and encoding visual representation. In addition, the student is required to analyze the problem, and to notice the relationship between objects.

Draw a line so that it starts in the lower left corner, passes between the circles, above the rectangle, below the triangle, and ends in the upper right corner.	

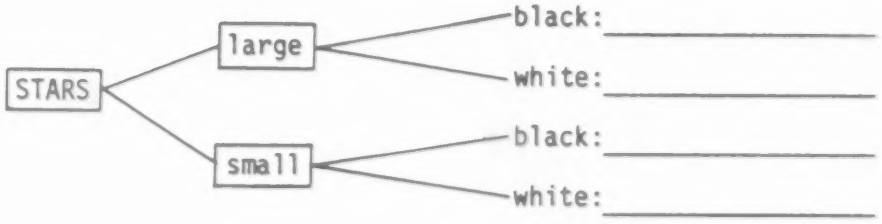
6. Categorization

This unit is designed to help the students learn to organize information hierarchically into superordinate cetagories. Objects and concepts are grouped according to underlying principles and are subsumed into appropriate sets.

Subject of classification: STARS

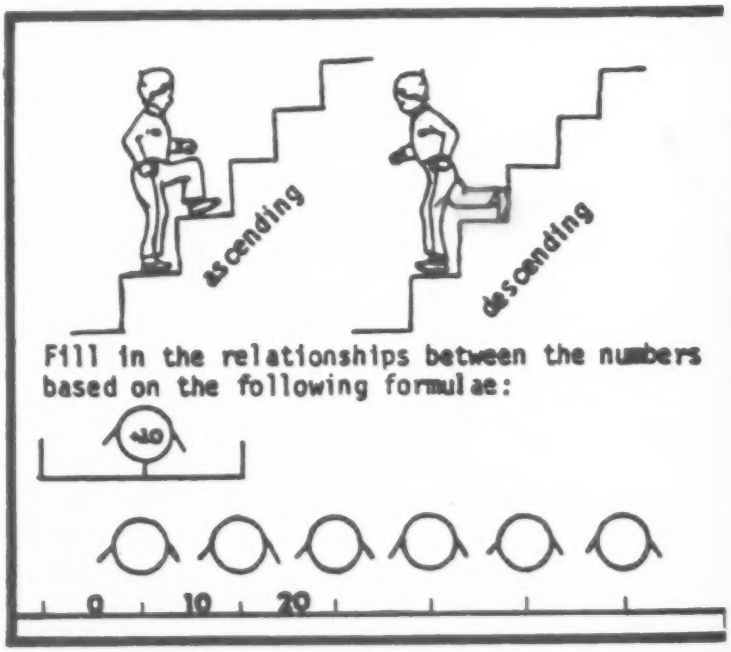
Principles of classification: size: (1) large (2) small

color: (1) black (2) white



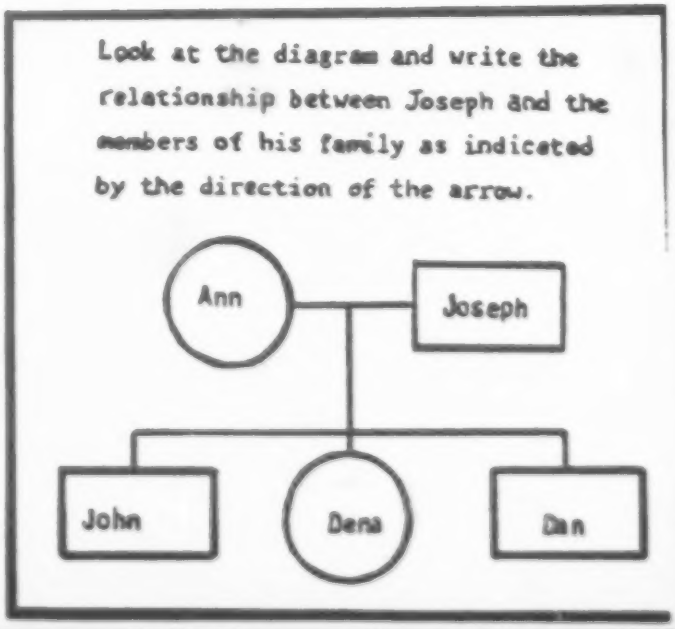
7. Numerical Progression

The focus of this instrument is the search for the rules and laws which are at the basis of certain experienced events and the education of the relationships existing between them. The order and the rhythmic appearance of these relationships are then formulated as rules by help of which the given sequence can be constructed or predicted. Numerical Progression is used mainly for the development of an orientation to perceive disparate and discrete objects and events as being linked by some kind of relationship which one can deduce.



8. Family Relationships

This instrument provides the learner with the rational, abstract elaboration of relationships experienced by him in his daily life. Another objective is to teach students to protect the relationship as a special link between two (or more) separate existences.


Look at the diagram and write the relationship between Joseph and the members of his family as indicated by the direction of the arrow.
Ann
Joseph
John
Dena
Dan

APPENDIX D

TEACHER ATTITUDES TOWARD

LOW ACHIEVING STUDENTS SCALE

Name: _____

Subject Areas Taught: _____

Levels Taught: _____

No. of Years at Van Horne: _____

Today's Date: _____

We are interested in the problems that many students with normal intelligence have in school. As you may know, there are many students who according to their I.Q. scores have the potential to do well in school but who are not.

The following questions refer to this group of students.

1) Normally intelligent students fail in school for a number of reasons. Of such students you have known at Van Horne check all that apply and rank (1=highest) following in order of probability of causing failure.

		Applies	Rank
1)	Negative attitudes toward learning	_____	____
2)	Lack of motivation	_____	____
3)	Poor Reading skills	_____	____
4)	Poor Math skills	_____	____
5)	Poor Thinking skills	_____	____
6)	Poor Learning strategies	_____	____
7)	Conduct problems	_____	____
8)	Emotional problems	_____	____
9)	Other _____	_____	____

2) Which of the causes for failure can be changed. Check all that you believe can be changed in the school setting and rank order them in terms of ease or likehood of change. (1=easiest or most likely)

		Change	Rank
1)	Negative attitudes toward learning	_____	____
2)	Lack of motivation	_____	____
3)	Poor Reading skills	_____	____
4)	Poor Math skills	_____	____
5)	Poor Thinking skills	_____	____

	Change	Rank
6) Poor Learning strategies	_____	____
7) Conduct problems	_____	____
8) Emotional problems	_____	____
9) Other _____	_____	____

3) Assuming all the reasons for failure can be changed rank order them in terms of importance. Which if changed would be most important to the child's overall success in school.

	Rank (1=Most Important)
1) Negative attitudes toward learning	____
2) Lack of motivation	____
3) Poor Reading skills	____
4) Poor Math skills	____
5) Poor Thinking skills	____
6) Poor Learning strategies	____
7) Conduct problems	____
8) Emotional problems	____
9) Other _____	____

4) Check below where students are receiving help at Van Horne.

	Check	By Whom or In What Program
1) Negative attitudes toward learning	_____	_____
2) Lack of motivation	_____	_____
3) Poor Reading skills	_____	_____
4) Poor Math skills	_____	_____
5) Poor Thinking skills	_____	_____
6) Poor Learning strategies	_____	_____
7) Conduct problems	_____	_____
8) Emotional problems	_____	_____
9) Other _____	_____	_____

5) What happens to Students when they leave Van Horne?. Check all that apply and rank order in terms of greatest frequency. (1 = highest frequency)

	Applies	Rank
1) Go on to further education SAIT, AVC, VRRI, Other. (circle one)	_____	____
2) Get further on the job training related to vocational training at Van Horne	_____	____
3) Get on the job training unrelated to vocational training at Van Horne	_____	____
4) Get employment not requiring specific job skills (E.G. pumping gas, waiter)	_____	____
5) Are unemployed	_____	____
6) Begin but do not maintain employment	_____	____
7) Run afoul of the law and spend time in jail	_____	____

6) Do you know about the Instrumental Enrichment Program at Van Horne?. Yes No

7) How do you know about it?.

	Check
1) Inservices on Instrument Enrichment	_____
2) Have students in program	_____
3) Other Teachers have talked about it	_____
4) University courses	_____
5) Other _____	_____

8) Describe briefly what you know about the program.

_____

_____

_____

_____

_____

_____

9) If you think this program can potentially make a difference for students who are failing, check the causes for failure you think this program may affect.

		Check
1)	Negative attitudes toward learning	_____
2)	Lack of motivation	_____
3)	Poor Reading skills	_____
4)	Poor Math skills	_____
5)	Poor Thinking skills	_____
6)	Poor Learning strategies	_____
7)	Conduct problems	_____
8)	Emotional problems	_____
9)	Other_____	_____

10) If you have personally observed any changes in students that could be attributed to their participation in the Instrumental Enrichment program, check any that you have observed, and comment on where observed, if possible.

		Check	Where Observed
1)	Negative attitudes toward learning	_____	_____
2)	Lack of motivation	_____	_____
3)	Poor Reading skills	_____	_____
4)	Poor Math skills	_____	_____
5)	Poor Thinking skills	_____	_____
6)	Poor Learning strategies	_____	_____
7)	Conduct problems	_____	_____
8)	Emotional problems	_____	_____
9)	Other_____	_____	_____
10)	No changes observed	_____	_____

APPENDIX E

DESCRIPTION OF THE STONY BROOK CLASSROOM OBSERVATION CODE

DESCRIPTION OF THE STONY BROOK CLASSROOM OBSERVATION CODE

There are two general categories of behaviour in this code. Times behaviours are those which must persist for an entire 15 second interval before they are recorded. Untimed bheaviours are recorded each time they occur regardless of the duration of the behaviour. The behaviour may be only checked once in each 15 second interval.

1. INTERFERENCE: This category is intended to detect any verbal or physical behaviours or noises which are disturbing to others; the purpose here is to detect a discrete and distinct behaviour (such as calling out or clowning) which does not necessarily persist. This category is coded as an untimed behaviour.

2. OFF-TASK: This category is intended to monitor behaviour where the child, after initiating the appropriate task relevant behaviour, attends to stimuli other than the assigned work. This category is coded as a timed behaviour.

3. NON-COMPLIANCE: This category is intended to monitor behaviours which reflect a failure on the part of the child to follow teacher instructions. This category is coded as a timed behaviour.

4. MINOR MOTOR MOVEMENT: This category is intended to monitor behaviours of the child which are indicative of restlessness and fidgeting such as rocking movements or twisting and turning in a seated position. This category is coded as an untimed behaviour.

5. GROSS MOTOR STANDING: This category refers to motor activity which results in the child leaving his seat and standing on at least one leg (on the floor, chair, or dest). This category is coded as an untimed behaviour.

6. OUT-OF-CHAIR BEHAVIOUR: This category is intended to monitor extended out-of-seat behaviour. It is coded as a timed behaviour.

7. RESPONDS TO QUESTION: The student volunteers to answer a question asked by the teacher.

8. REQUEST FOR CLARIFICATION: The student asks the teacher to clarify a statement made by the teacher.